that would be requisite. Adequate preparation of a scheme may take several years, perhaps in the circumstances a fortunate delay. For a new "Challenger" expedition will be very costly, and we trust that the government and the national finances will then be in a better position to undertake what certainly should be a national enterprise.—The London *Times*.

SCIENTIFIC BOOKS

Principles of Animal Biology. By A. Franklin Shull, with the collaboration of George R. La Rue and Alexander G. Ruthven. McGraw-Hill Book Co., Inc., New York.

Most teachers of elementary zoology have for some time acknowledged that the almost exclusively morphological texts fail to give the beginner in the science a fair introduction to the field of zoology. Several recent texts and revisions of some of the older ones have endeavored to meet the demand for a more thorough treatment of the underlying principles of the subject. For one reason or another most of these attempts have failed to meet with general approval. In many instances they have remained predominantly morphological with intercalated sections on the principles. The Principles of Animal Biology by Shull, La Rue and Ruthven promises to meet the requirement for a text dealing with the fundamental biological principles far better than any other that has appeared to date.

Throughout the text there are brought together distinctly modern view points regarding the various subsciences of zoology. The book is not only well written so that the reader is fascinated by the smoothness of the narration but in addition it has all appearances of being so organized that it may be easily assimilable by the beginning student. In only a few instances does the treatment seem to be beyond the grasp of the average student. In the discussion of the physiology of cells (Chapter III.) the extent of chemical knowledge assumed to be possessed by the student is rather great. The structural formulas and the highly technical chemical terminology would not be intelligible to the average freshman, but this is not any fundamental criticism of the book for most teachers are coming to realize that a certain amount of consideration must be given the unusual student.

The book is distinctly the result of a reactionary movement away from the more stolidly morphological and taxonomic treatment of the subject of zoology. A point might be raised as to whether it is not possible that the taxonomic aspect has been curtailed to the extent of impoverishing the opportunity of citing comprehensible instances of the principles for the average student. Correlation of laboratory work and text assignments might easily obviate this possible difficulty. Content of an elementary course and the relative emphasis to be placed upon the various phases of the science are by no means matters of universal agreement among zoology teachers. Consequently a criticism like the foregoing may in the end prove to be either a valid judgment of the text of an ultimate criticism of the one offering it.

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SPECIAL ARTICLES

PRELIMINARY INVESTIGATION OF RIBES AS A CONTROLLING FACTOR IN THE SPREAD OF WHITE PINE BLISTER RUST[1]

Most authorities will now admit that the complete eradication of the white pine blister rust from the country is not possible, but they consider it both possible and feasible to control the disease to a certain extent and to protect certain definite areas of pine. It is also agreed that such protection must be exercised through the eradication of *ribes*.

Under these conditions, the control of the white pine blister rust, or rather the protection of the white pine, depends on a definite knowledge of the habits of *ribes*, especially of the wild plants, and their reactions to different treatments. Projects were there-

[1] Published with the approval of the Director as Paper No. 209, of the Journal Series of the Minnesota Agricultural Experiment Station.

fore planned and working plans drawn up to cover the following points.

For the purpose of these projects the land was classified into swamp, moist and dry.

PROJECT I

To study the sprouting of different species of ribes eradicated in different months and under different moisture conditions.

In the land which was cleared in May twenty-five bushes were located in dry ground and twenty-five in moist. No swamp was worked. These bushes were marked with numbered stakes and exactly located on a map.

The following data was noted for each bush: (*a*) whether plant was pulled or grubbed; (*b*) whether part of crown was left or only side roots; (*c*) whether sprouts came from the crown, the cut ends of side roots, or as suckers from the roots; (*d*) number of sprouts, date of sprouting and species.

This same schedule was duplicated on areas cleared in June, July, August and September.

Bushes were selected which were eradicated about the middle of the month, so that the intervals were about even.

PROJECT II

To study the cost and effectiveness of eradication of *ribes* in different months.

Five quarter-acre plots were laid out in dry land—either brush or forest land—not meadow or tilled land—in the area eradicated in May. The same was done on the moist land type.

This schedule also was repeated in June, July, August and September.

These plots were permanently marked with stakes, as they will probably be studied for the next three or four years at least.

After the eradication crew had gone over this area, the plots were carefully examined to see what was left. The plants found were classified by species as sprouts, seedlings under six inches, and old plants.

PROJECT III

To determine the number of years eradication will have to be practised.

The plots established for Project II. will be studied for a series of years, and the development of the *ribes* noted.

PROJECT IV

To study the reproduction of different species of *ribes* by seed and layering.

A number of plants of each species were located in both moist and dry types in pine woods, in hardwoods, in brush land, in sod land and in swamps.

Seed was collected from each species at weekly intervals and in all stages of maturity. Some of it was tested at once for germination, some was stratified and held for germination tests in the spring.

Plots of seedlings were staked out and counted from time to time and survival noted. They will be checked again in the spring to see how many were winter killed.

PROJECT V

To determine the effect of pruning and cutting off the roots at different depths and different dates.

A number of bushes of each species were located both in the dry land and moist types.

Some of these were cut off above the crown, some just below the crown and some six inches below the surface.

This was done in June and duplicated in August.

PROJECT VI

To determine growth habits of each species.

A number of plants were located and put under surveillance. Their future development will be studied.

The infected area around Rush Lake, Minnesota, was selected for the experiments. Eradication of *ribes* had been carried on there in the summer of 1918 and was in progress during the summer of 1919. It is a rolling country of hills, and swamps. All stages of cultivation are represented from wild woodland, through brushland and pasture, to cultivated fields. Most of the woodlands are made up of mixed hardwoods—butternut, red oak, white birch, bitternut, hickory, basswood, sugar maple and white ash, with a large mixture of black ash in the lowlands. Here and there is a small patch of pure white pine and

in many places there are a few white pine scattered through the hardwoods and pastures.

The ground cover is grass, goldenrod, blueberries, blackberries, raspberries and the common roadside weeds. The brush on the highland is prickly ash and hardwood reproduction with zones of dense alder and raspberries around the edges of the swamps. The soil is mostly sandy loam, rather light.

Five species or *ribes* are common there. *R. cynosbati* predominates on the dry lands. *R. oxyacanthoides, R. floridum, R. triste* and *R. prostratum* occur in the swamps in the order named.

The results of the first season's work under this program are interesting and significant, but not conclusive. The data in many instances was found to be too meager and at least one more season's work will be necessary before any very positive statements can be made, but there are some very strong indications.

There was a decidedly higher percentage of sprouts from the plants eradicated on the moist type than on either the dry or the swamp type. In fact no sprouts at all were found on either *R. triste* or *R. prostratum* in the swamps. This would seem to indicate that more sprouting might be expected from plants on the dry land type in a very wet summer than in a dry one.

There was a larger percentage of sprouts from the plants which were grubbed than from the plants which were pulled. It was significant that a majority of the sprouts on pulled plants came from the root ends, while a majority of those from the plants grubbed out came from pieces of the crown which were left. Only two root sprouts from grubbed plants were found. In no case, either from pulled or grubbed plants, were there any root sprouts, *except where the root ends were exposed to the light.*

The tendency to sprout from the root ends seemed much stronger in plants pulled in May and June than late in the summer. Possibly this was due to the greater moisture in the ground in the spring months. This did not apply to crown sprouts which seemed to develop equally well in any month of the summer.

Where plants were cut off above the crown they almost invariably sprouted in all types and at all seasons with the exception of the swamp species, triste, which showed very little tendency to sprout at all. Plants cut off below the crown showed very little tendency to sprout. In fact the only sprout found was on a root end which was dragged to the surface in the process and left exposed to the light.

A study of the plots laid out in the eradicated area seems to indicate that there is very little difference in the efficiency of radication in the dry, moist, or shallow swamp types, while the number of plants left in the deep swamp is hopelessly large. The eradication done in May and June seemed much less effective than that of July and August, but this may have been due to the fact that the crews were inexperienced at the start.

The number of large plants missed by the eradication crews was very small, representing on the average far less than five per cent. of the original stand.

The number of seedlings missed is naturally very much larger, but their leaf surface is very small, none of them were found to be infected and it is questionable whether they live over to the second season in very large numbers. Plots of seedlings counted in July and August and checked late in September showed a decrease of 25 per cent. while very few two-year-old seedlings were noted anywhere.

Up to December 1 no germination had been obtained from any of the seed collected the summer before.

CONCLUSIONS

Incomplete as this study is it seems to indicate an important change in the method of eradication. The number of large plants missed is very small, the number of seedlings, though large, is not excessively large, and the sprouts make up a very large per cent. of the leaf surface on eradicated land. If it is true, as this study indicates, that practically all of

the sprouts come from pieces of crown and from root ends which are exposed to the light, the sprout can be eliminated by careful practise in eradication. Cutting of the roots would seem to be more effective than pulling: ordinary care will prevent the leaving of pieces of crown in grubbing, while only extraordinary care and considerable work can prevent the leaving of exposed root ends after pulling. In the past it has been the custom in this state to pull whenever possible and to grub only as a last resort. It looks as though the practise should be reversed. The initial work may be a little more expensive, but it will be cheaper in the end if it eliminates the sprouts which make up the great bulk of the growth on eradicated areas.

According to the figures obtained the eradication crews attained an average efficiency of almost 99 per cent. on old bushes and seedlings. If the sprouts can be eliminated the reduced leaf surface should certainly give a large measure of protection if not complete exemption from the disease.

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THE AMERICAN CHEMICAL SOCIETY. XI

DIVISION OF AGRICULTURAL AND FOOD CHEMISTRY

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T. J. Bryan, *secretary*

Louisiana molasses and syrup: C. E. COATES.

The use of refined edible lactic acid in food products: GEORGE DEFREN.

Preliminary feeding experiments with pigs to determine the nutritive value of the amino acids of the proteins of feeding stuffs: H. S. GRINDLEY.

Proteins of pecans: C. T. DOWELL.

Body fat of hogs fed on peanuts: FRED H. SMITH.

An accurate and rapid dry combustion method for the simultaneous determination of soil organic matter and organic carbon: J. W. REED.

The actual carbon content of soil organic matter and its relation to the use of conventional factor: J. W. REED and R. H. RIDGELL.

Limitations of the white rat as an experimental animal: W. D. RICHARDSON.

Mammalian vs. Avian dietary experiments: W. D. RICHARDSON.

The ether insoluble hexabromides of pure and adulterated linseed oils: HERBERT BAILEY and W. D. BALDSIEFEN. Several modifications of the various methods which have been proposed from time to time for the determination of the hexabromide value of oils have been studied. As a result of this work a new method has been developed which, it is believed, is as accurate as any of those previously proposed, and more simple than most of them. The hexabromide values of a number of samples of pure linseed, soya bean, and other oils, and mixtures of linseed with soya bean oils have been determined.

The relative nutritive value of alfalfa as a supplement to a diet of corn and tankage, and kaffir and tankage: J. S. HUGHES and E. F. FERRIN.

Data on bacterial counts of beverages in Missouri: JAY BARTON. Excluding 23 samples from 3 different plants which were in an appalling condition, the average count for the remaining 203 samples is 71 per cubic centimeter. The three worst plants were in towns of population 5,000 or less. The average count of all samples from each of three other plants was between 100 per cubic centimeter and 150 per cubic centimeter; these plants were located in cities of 40,000 or more. *B. coli* were found in 8 samples collected from 5 plants. Only one of these plants was in a small town; the other four were in cities of 75,000 or more. *B. coli* were found in all of the products from one company manufacturing imitation wine. "Fancy" ginger ale (4 samples), grape juice (8 samples) and dealcoholized beer (80 samples) run uniformly good, about half of the samples containing no organisms growing at 37° C., and not more than 5 per cent. containing more than 10 per cubic centimeter.

The occurrence of hydrocyanic acid in Sudan grass and its effect on cattle: C. O. SWANSON. Samples of Sudan grass taken from a pasture where cows were feeding showed that large amounts of hydrocyanic acid was present, but no ill effects were observed. Sudan grass which was reported to have killed cattle did not apparently contain more of the HCN than the grass from the pasture mentioned. Conditions which favor enzyme action liberate hydrocyanic acid. Frosted Sudan grass gave a stronger test than that not frozen, but the HCN disappears very rapidly when the plant thaws out and dries. Ensiloing favors the liberation of